FIG. 1

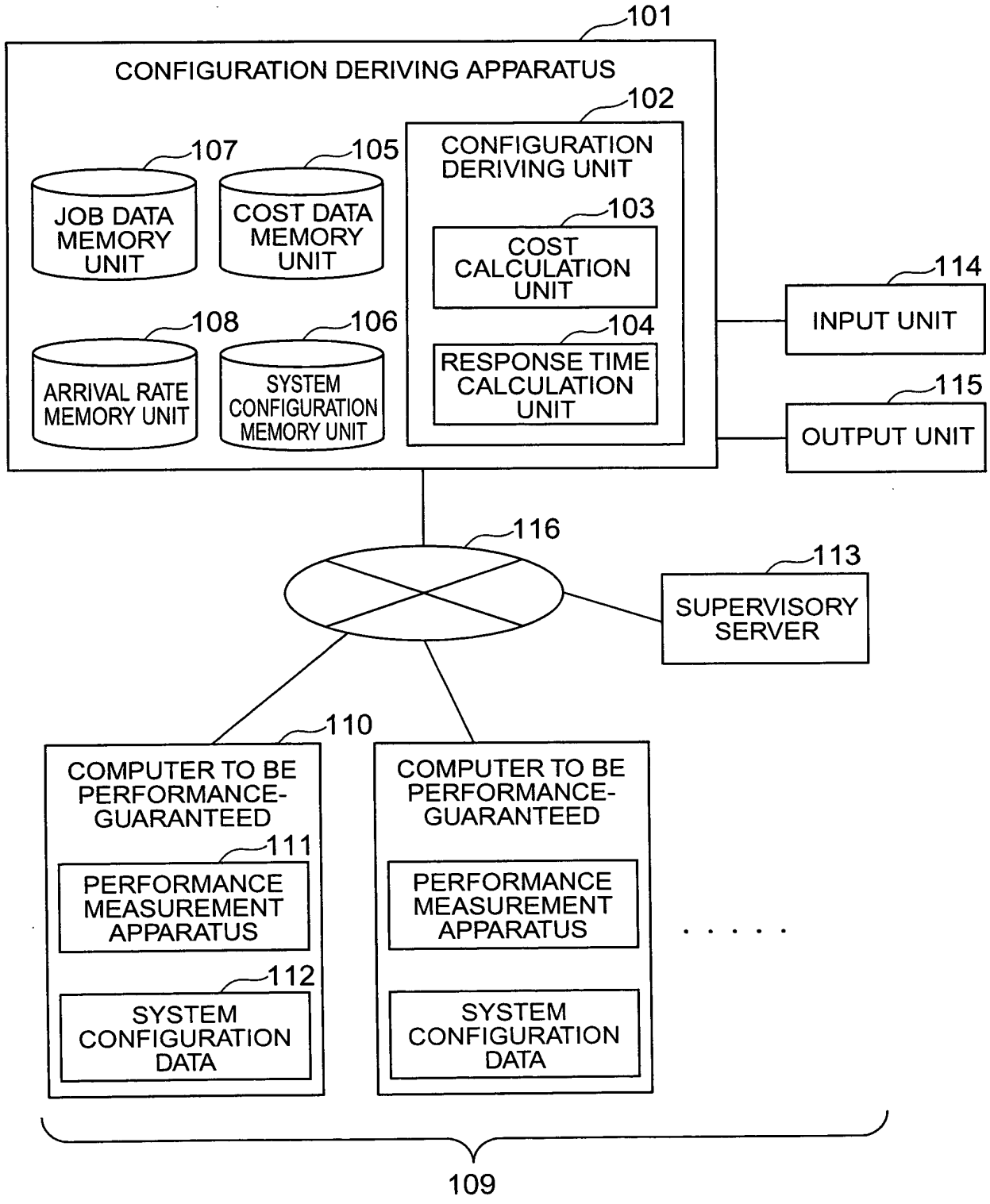
101
CONFIGURATION DERIVING APPARATUS
102
CONFIGURATION DERIVING UNIT
107
JOB DATA MEMORY UNIT
105
COST DATA MEMORY UNIT
103
COST CALCULATION UNIT
114
INPUT UNIT
108
ARRIVAL RATE MEMORY UNIT
106
SYSTEM CONFIGURATION MEMORY UNIT
104
RESPONSE TIME CALCULATION UNIT
115
OUTPUT UNIT
116
113
SUPERVISORY SERVER
110
COMPUTER TO BE PERFORMANCE-GUARANTEED
111
PERFORMANCE MEASUREMENT APPARATUS
112
SYSTEM CONFIGURATION DATA
COMPUTER TO BE PERFORMANCE-GUARANTEED
PERFORMANCE MEASUREMENT APPARATUS
SYSTEM CONFIGURATION DATA
109

FIG. 2

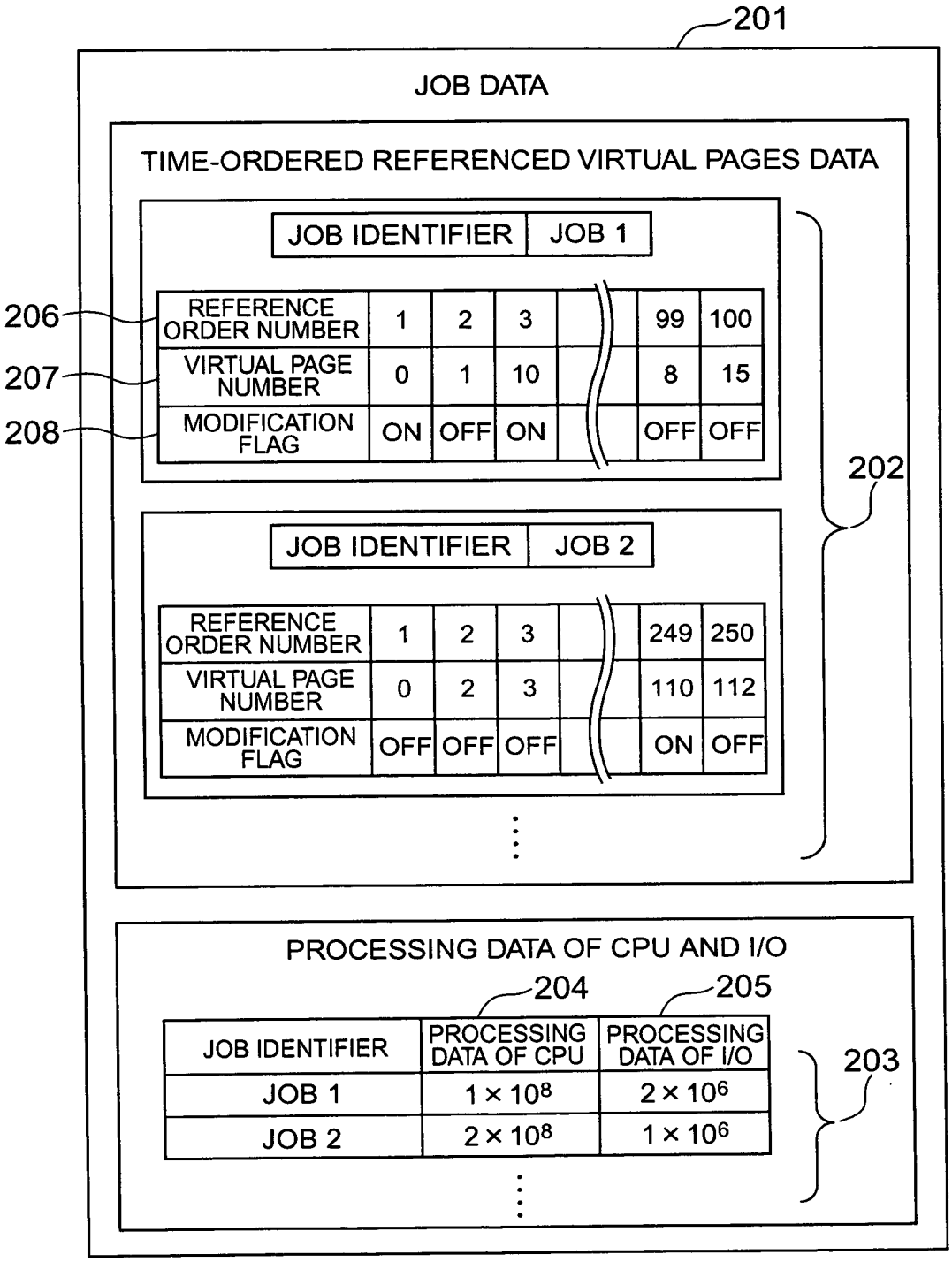
201
JOB DATA
TIME-ORDERED REFERENCED VIRTUAL PAGES DATA
JOB IDENTIFIER
JOB 1
206
REFERENCE ORDER NUMBER
1
2
3
99
100
207
VIRTUAL PAGE NUMBER
0
1
10
8
15
208
MODIFICATION FLAG
ON
OFF
ON
OFF
OFF
202
JOB IDENTIFIER
JOB 2
REFERENCE ORDER NUMBER
1
2
3
249
250
VIRTUAL PAGE NUMBER
0
2
3
110
112
MODIFICATION FLAG
OFF
OFF
OFF
ON
OFF
PROCESSING DATA OF CPU AND I/O
204
205
JOB IDENTIFIER
PROCESSING DATA OF CPU
PROCESSING DATA OF I/O
JOB 1
1 × 10^8
2 × 10^6
JOB 2
2 × 10^8
1 × 10^6
203

FIG. 3

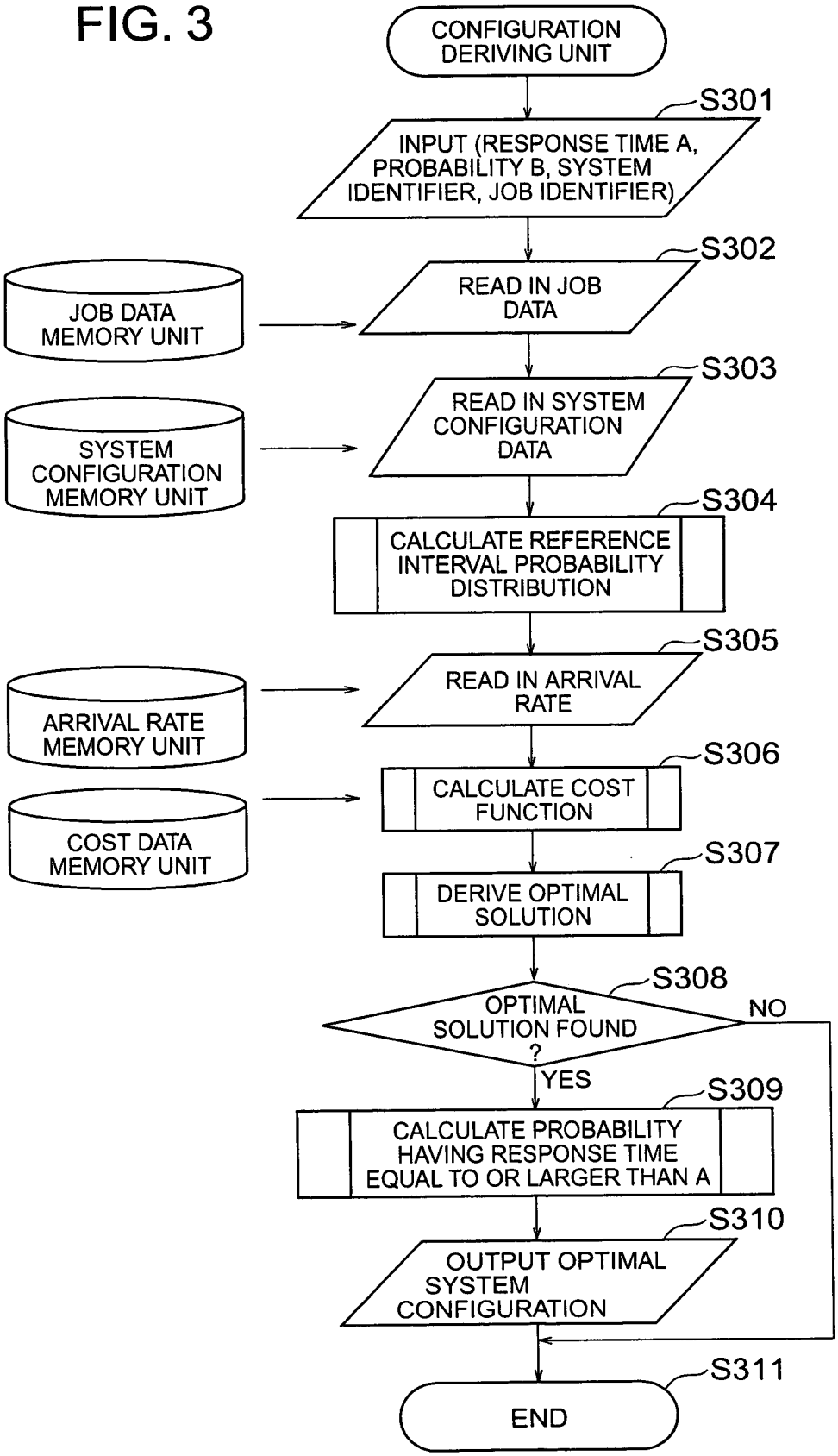
CONFIGURATION DERIVING UNIT
S301
INPUT (RESPONSE TIME A, PROBABILITY B, SYSTEM IDENTIFIER, JOB IDENTIFIER)
S302
READ IN JOB DATA
JOB DATA MEMORY UNIT
S303
READ IN SYSTEM CONFIGURATION DATA
SYSTEM CONFIGURATION MEMORY UNIT
S304
CALCULATE REFERENCE INTERVAL PROBABILITY DISTRIBUTION
S305
READ IN ARRIVAL RATE
ARRIVAL RATE MEMORY UNIT
S306
CALCULATE COST FUNCTION
COST DATA MEMORY UNIT
S307
DERIVE OPTIMAL SOLUTION
S308
OPTIMAL SOLUTION FOUND ?
NO
YES
S309
CALCULATE PROBABILITY HAVING RESPONSE TIME EQUAL TO OR LARGER THAN A
S310
OUTPUT OPTIMAL SYSTEM CONFIGURATION
S311
END

FIG. 4

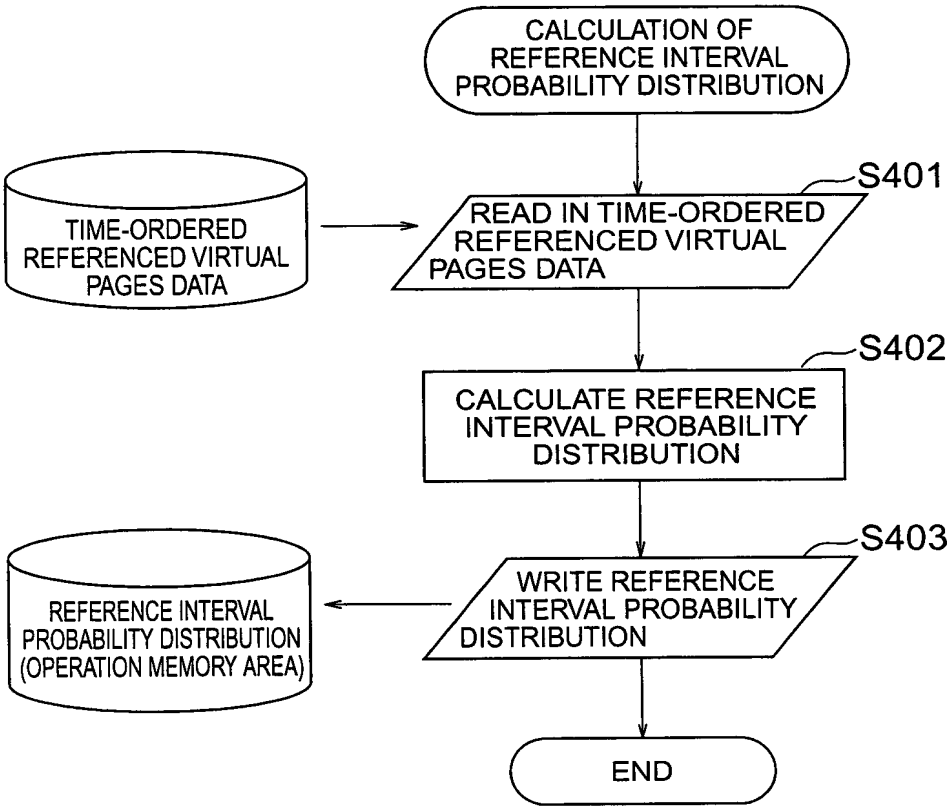
CALCULATION OF REFERENCE INTERVAL PROBABILITY DISTRIBUTION
TIME-ORDERED REFERENCED VIRTUAL PAGES DATA
S401
READ IN TIME-ORDERED REFERENCED VIRTUAL PAGES DATA
S402
CALCULATE REFERENCE INTERVAL PROBABILITY DISTRIBUTION
S403
WRITE REFERENCE INTERVAL PROBABILITY DISTRIBUTION
REFERENCE INTERVAL PROBABILITY DISTRIBUTION (OPERATION MEMORY AREA)
END

FIG. 5

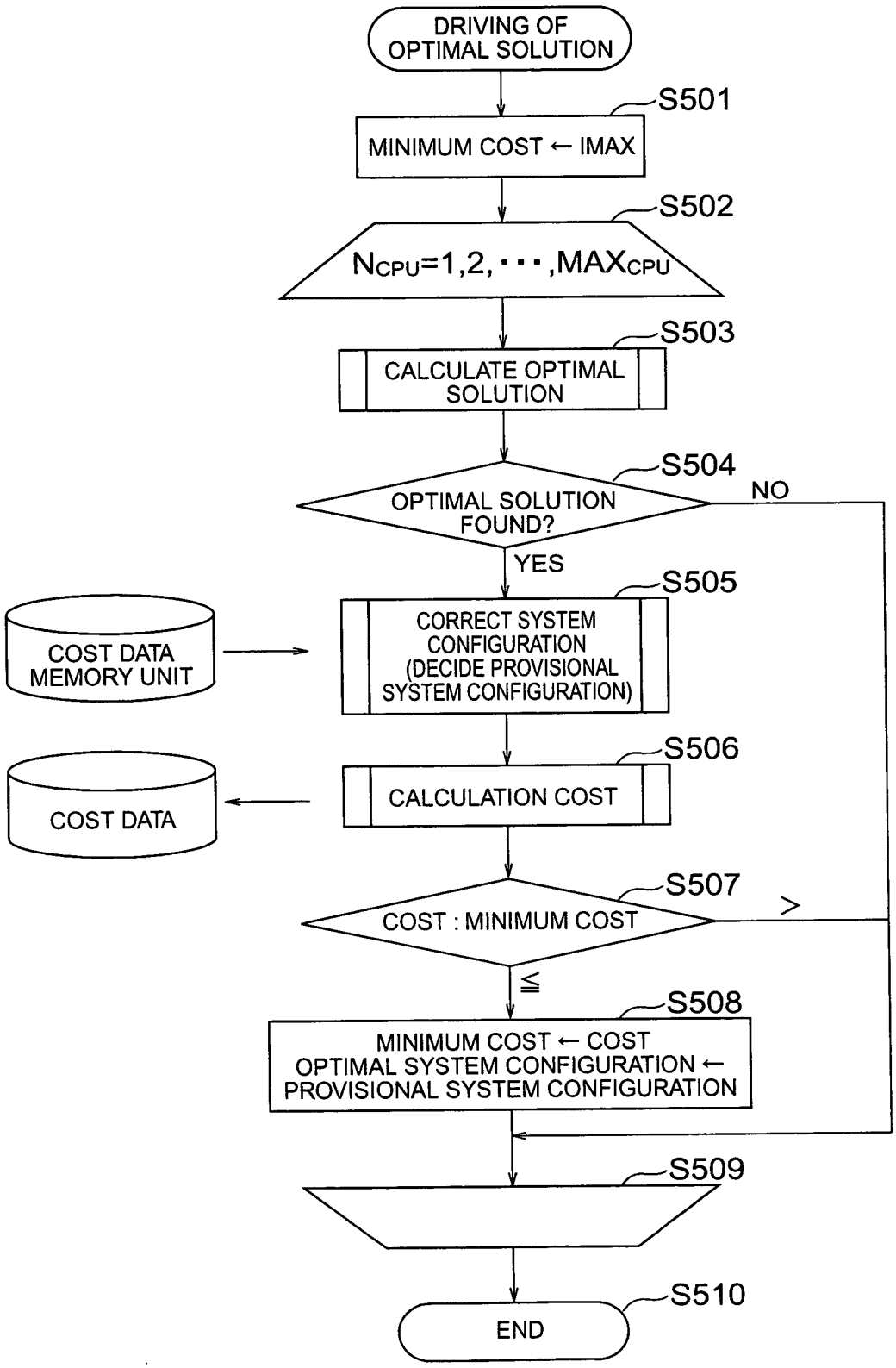
DRIVING OF OPTIMAL SOLUTION
S501
MINIMUM COST ← IMAX
S502
N_{CPU}=1,2,・・・,MAX_{CPU}
S503
CALCULATE OPTIMAL SOLUTION
S504
OPTIMAL SOLUTION FOUND?
NO
YES
S505
CORRECT SYSTEM CONFIGURATION (DECIDE PROVISIONAL SYSTEM CONFIGURATION)
COST DATA MEMORY UNIT
S506
CALCULATION COST
COST DATA
S507
COST : MINIMUM COST
>
≦
S508
MINIMUM COST ← COST
OPTIMAL SYSTEM CONFIGURATION ← PROVISIONAL SYSTEM CONFIGURATION
S509
S510
END

FIG. 6

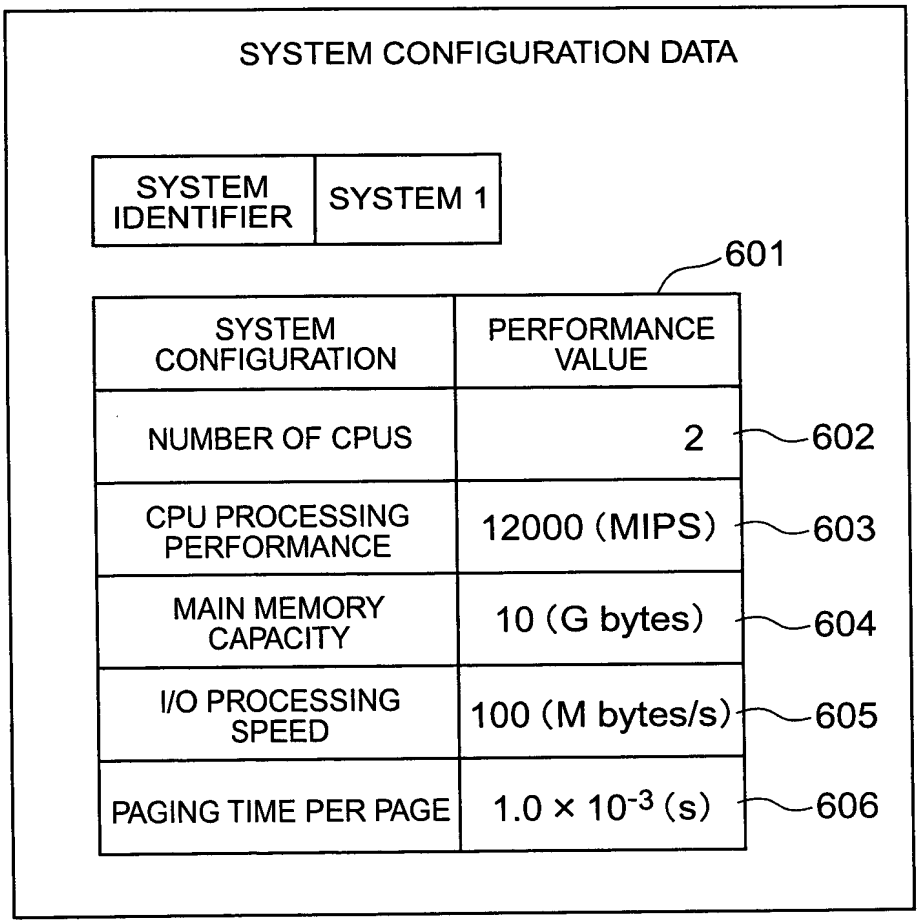
SYSTEM CONFIGURATION DATA
SYSTEM IDENTIFIER
SYSTEM 1
601
SYSTEM CONFIGURATION
PERFORMANCE VALUE
NUMBER OF CPUS
2
602
CPU PROCESSING PERFORMANCE
12000 (MIPS)
603
MAIN MEMORY CAPACITY
10 (G bytes)
604
I/O PROCESSING SPEED
100 (M bytes/s)
605
PAGING TIME PER PAGE
1.0 × 10-3 (s)
606

FIG. 7

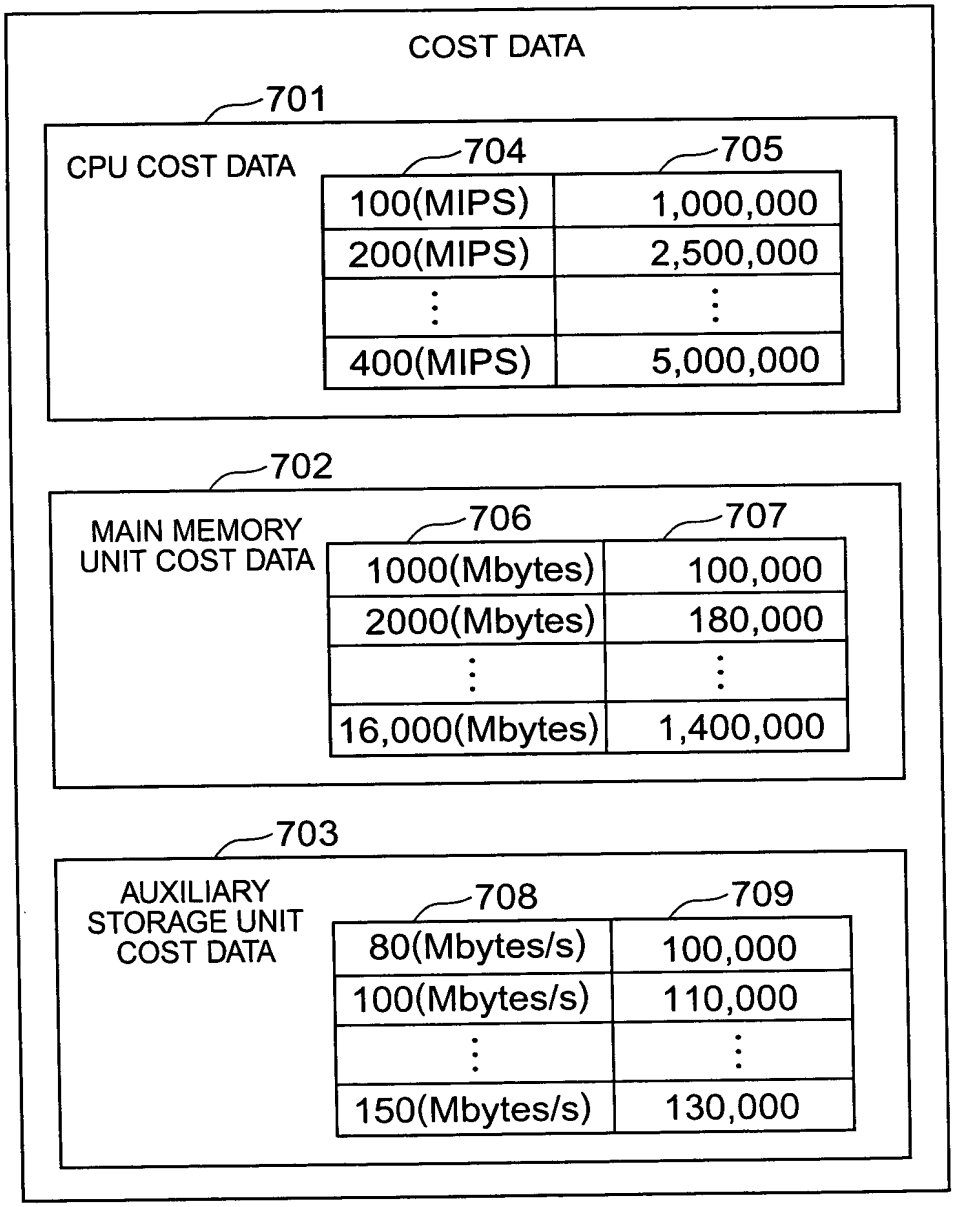
COST DATA
701
CPU COST DATA
704
705
100(MIPS)
1,000,000
200(MIPS)
2,500,000
400(MIPS)
5,000,000
702
MAIN MEMORY UNIT COST DATA
706
707
1000(Mbytes)
100,000
2000(Mbytes)
180,000
16,000(Mbytes)
1,400,000
703
AUXILIARY STORAGE UNIT COST DATA
708
709
80(Mbytes/s)
100,000
100(Mbytes/s)
110,000
150(Mbytes/s)
130,000

FIG. 8

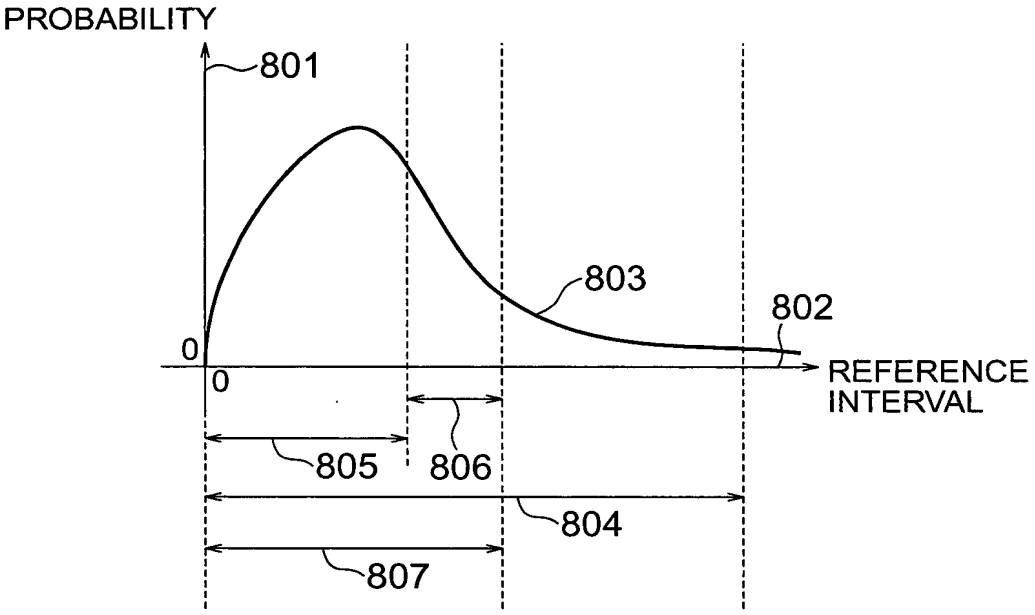
PROBABILITY
801
803
802
0
0
REFERENCE
INTERVAL
805
806
804
807

FIG. 9

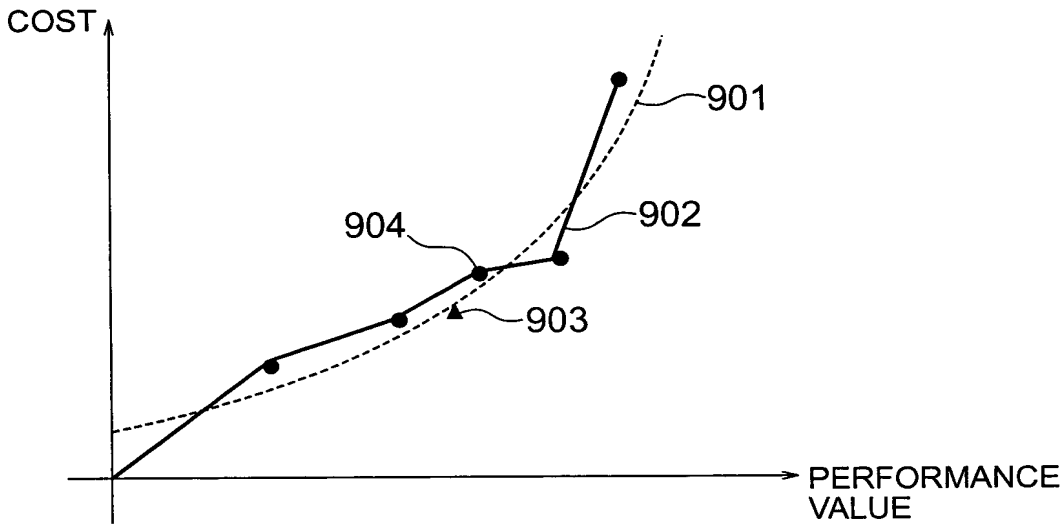

FIG. 10

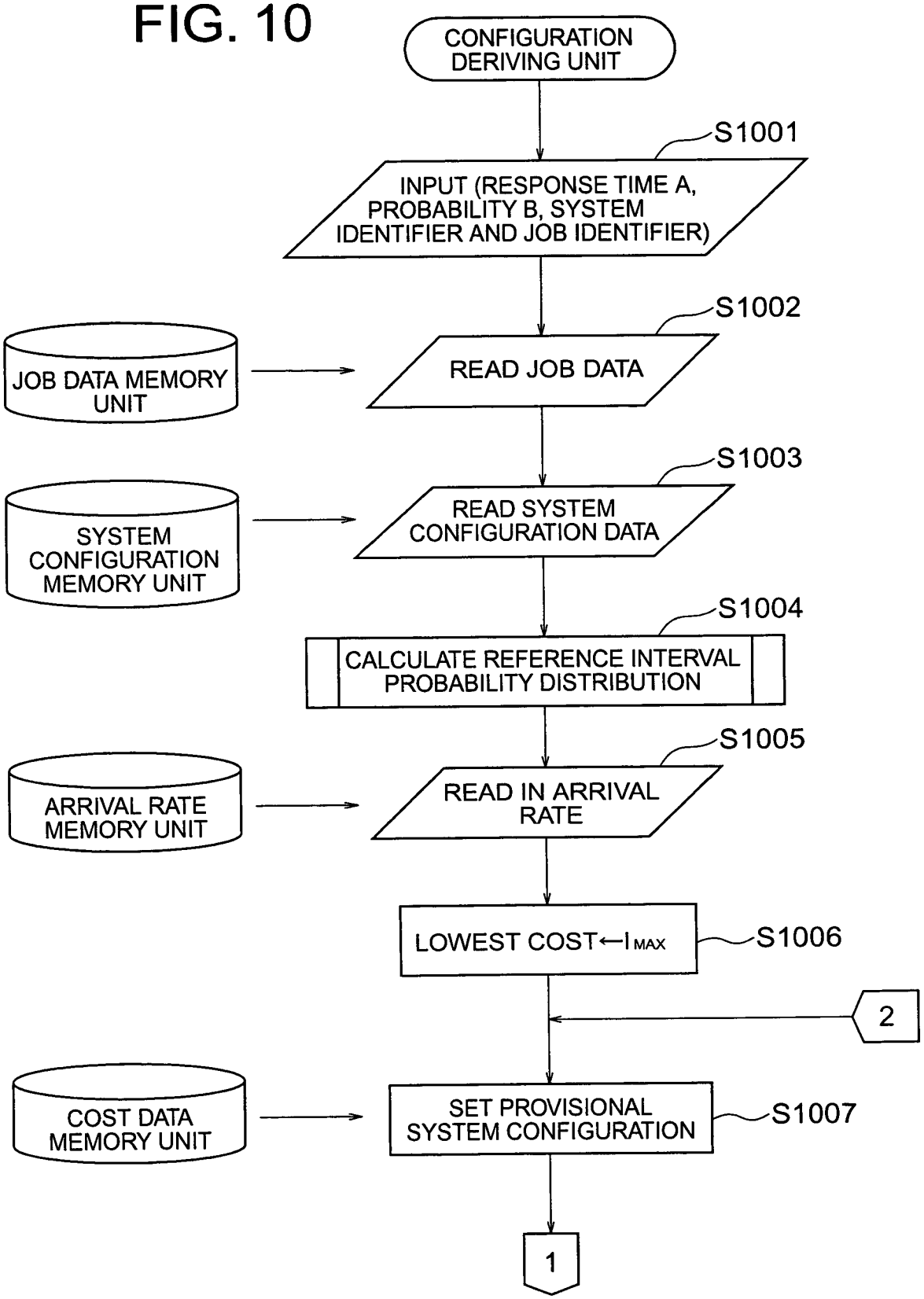
CONFIGURATION DERIVING UNIT
S1001
INPUT (RESPONSE TIME A, PROBABILITY B, SYSTEM IDENTIFIER AND JOB IDENTIFIER)
S1002
JOB DATA MEMORY UNIT
READ JOB DATA
S1003
SYSTEM CONFIGURATION MEMORY UNIT
READ SYSTEM CONFIGURATION DATA
S1004
CALCULATE REFERENCE INTERVAL PROBABILITY DISTRIBUTION
S1005
ARRIVAL RATE MEMORY UNIT
READ IN ARRIVAL RATE
LOWEST COST←I MAX
S1006
2
COST DATA MEMORY UNIT
SET PROVISIONAL SYSTEM CONFIGURATION
S1007
1

FIG. 11

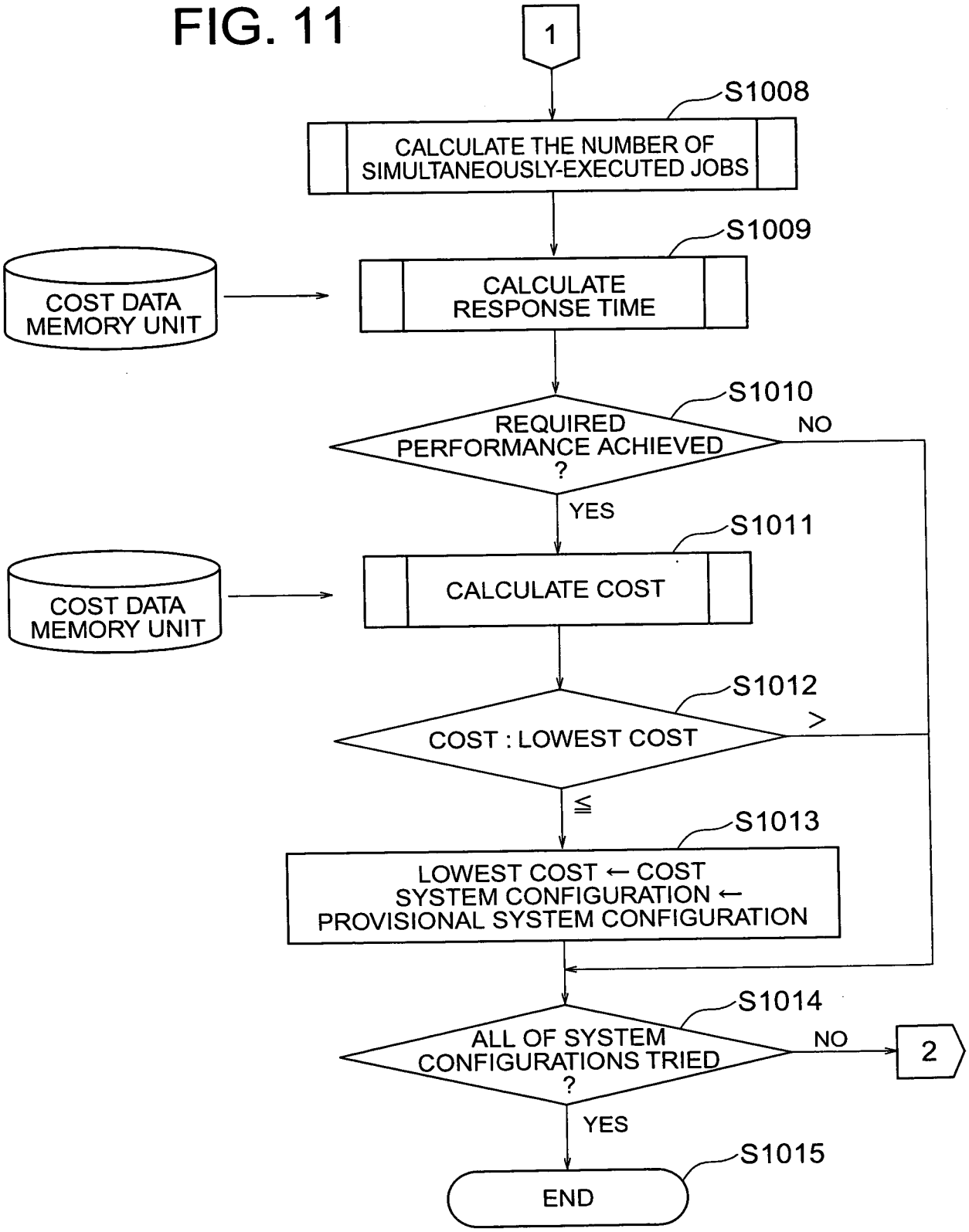
1
S1008
CALCULATE THE NUMBER OF SIMULTANEOUSLY-EXECUTED JOBS
S1009
COST DATA MEMORY UNIT
CALCULATE RESPONSE TIME
S1010
REQUIRED PERFORMANCE ACHIEVED ?
NO
YES
S1011
COST DATA MEMORY UNIT
CALCULATE COST
S1012
COST : LOWEST COST
>
≦
S1013
LOWEST COST ← COST
SYSTEM CONFIGURATION ← PROVISIONAL SYSTEM CONFIGURATION
S1014
ALL OF SYSTEM CONFIGURATIONS TRIED ?
NO
2
YES
S1015
END

FIG. 12

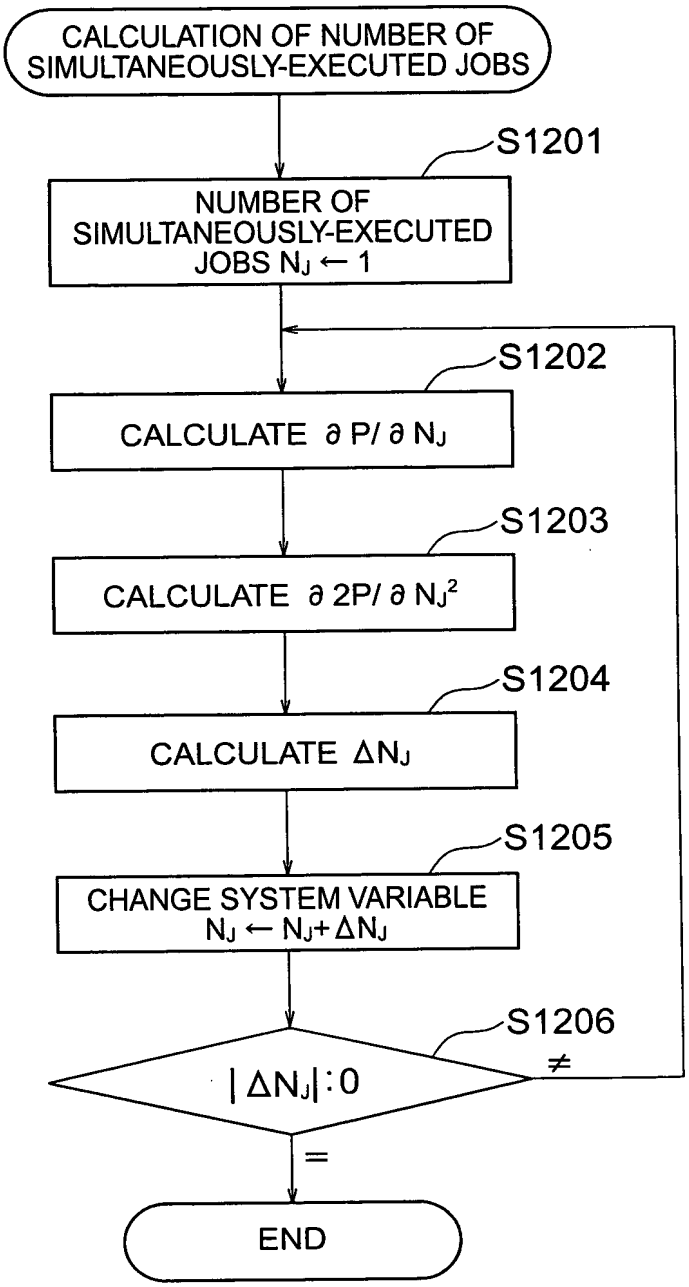
CALCULATION OF NUMBER OF SIMULTANEOUSLY-EXECUTED JOBS
S1201
NUMBER OF SIMULTANEOUSLY-EXECUTED JOBS $N_J \leftarrow 1$
S1202
CALCULATE $\partial P / \partial N_J$
S1203
CALCULATE $\partial 2P / \partial N_J^2$
S1204
CALCULATE ΔN_J
S1205
CHANGE SYSTEM VARIABLE $N_J \leftarrow N_J + \Delta N_J$
S1206
$|\Delta N_J| : 0$
≠
=
END

FIG. 13

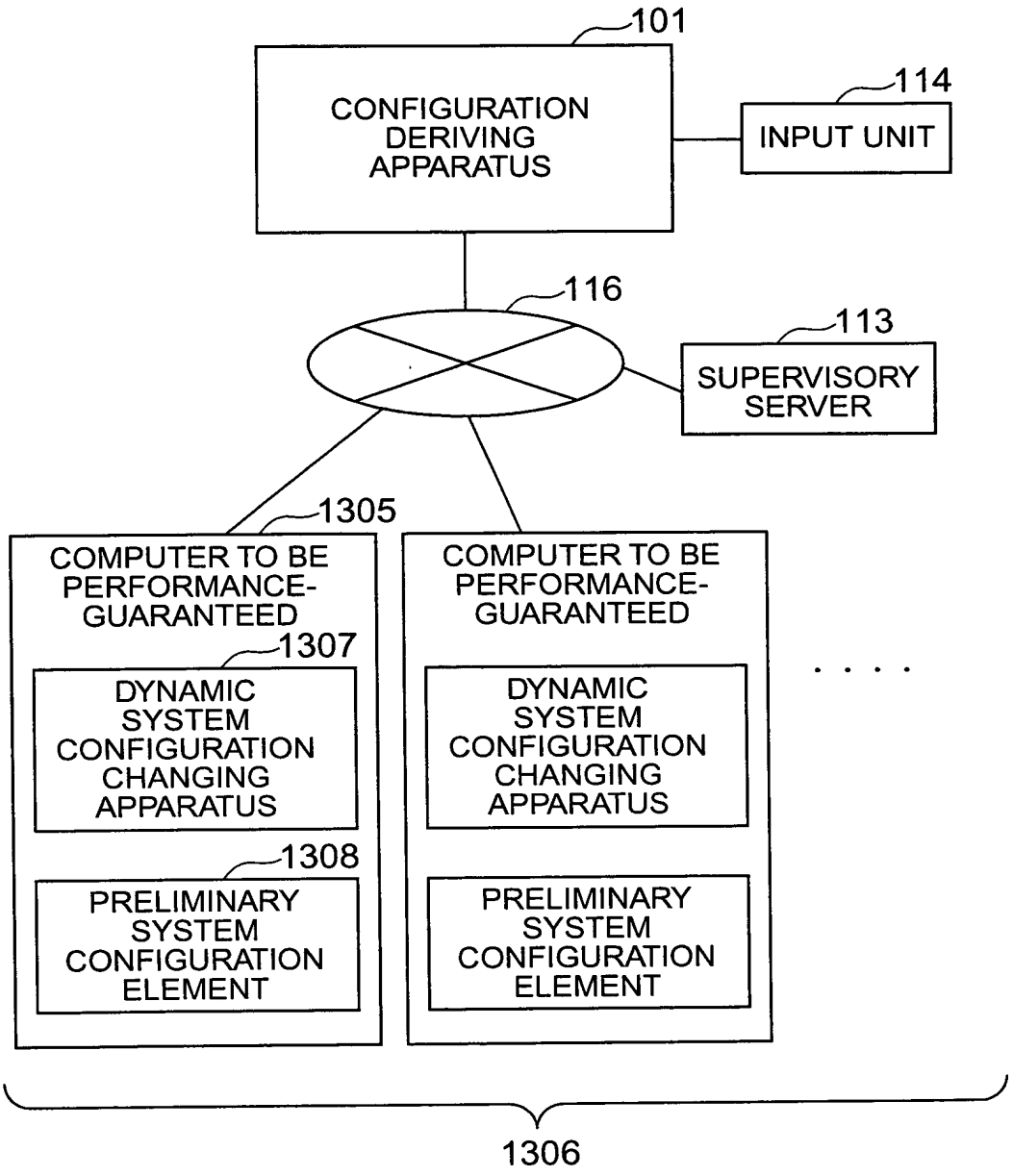
101
CONFIGURATION DERIVING APPARATUS
114
INPUT UNIT
116
113
SUPERVISORY SERVER
1305
COMPUTER TO BE PERFORMANCE-GUARANTEED
1307
DYNAMIC SYSTEM CONFIGURATION CHANGING APPARATUS
1308
PRELIMINARY SYSTEM CONFIGURATION ELEMENT
COMPUTER TO BE PERFORMANCE-GUARANTEED
DYNAMIC SYSTEM CONFIGURATION CHANGING APPARATUS
PRELIMINARY SYSTEM CONFIGURATION ELEMENT
1306

FIG. 14

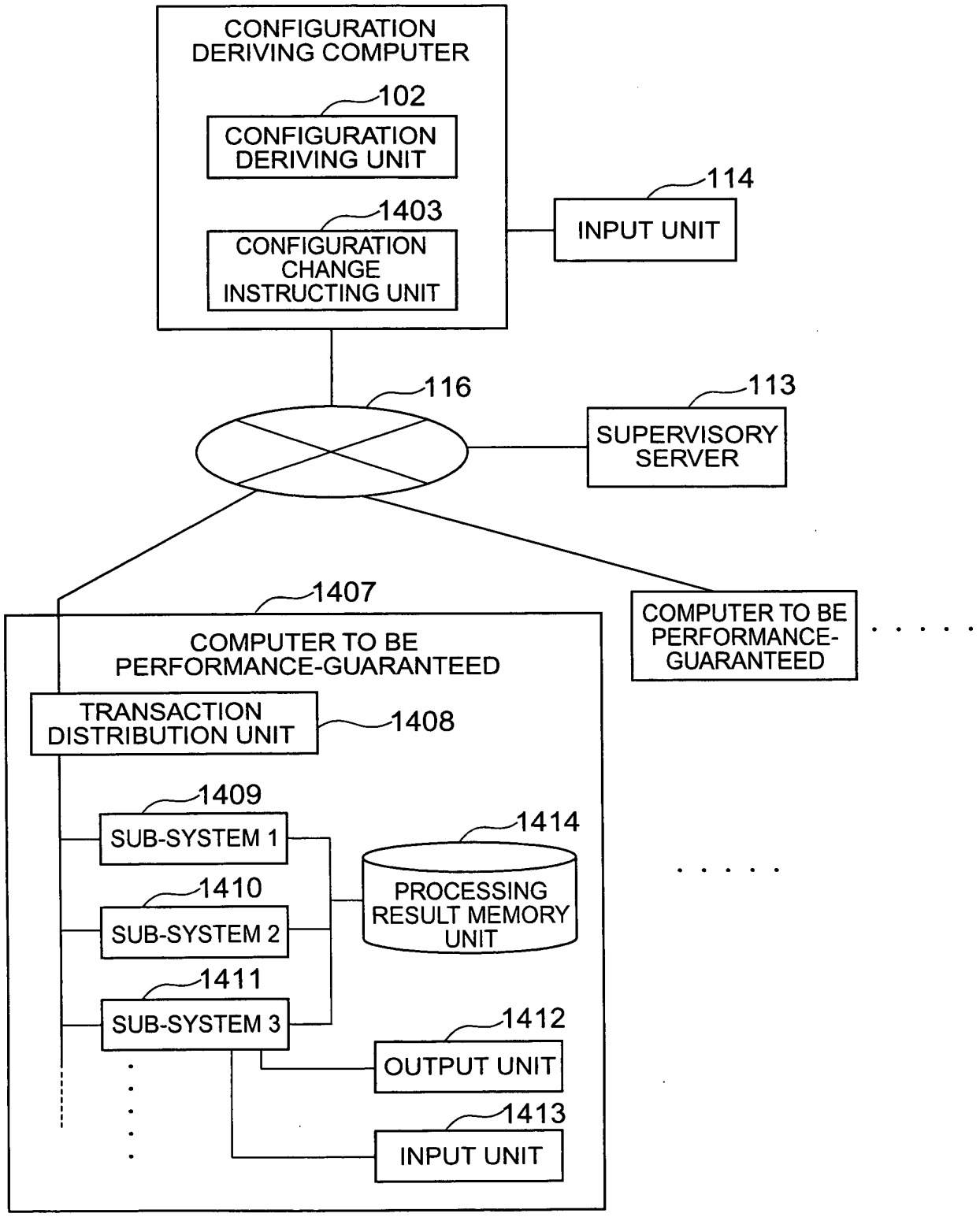
CONFIGURATION DERIVING COMPUTER
102
CONFIGURATION DERIVING UNIT
1403
CONFIGURATION CHANGE INSTRUCTING UNIT
114
INPUT UNIT
116
113
SUPERVISORY SERVER
1407
COMPUTER TO BE PERFORMANCE-GUARANTEED
TRANSACTION DISTRIBUTION UNIT
1408
1409
SUB-SYSTEM 1
1410
SUB-SYSTEM 2
1411
SUB-SYSTEM 3
1414
PROCESSING RESULT MEMORY UNIT
1412
OUTPUT UNIT
1413
INPUT UNIT
COMPUTER TO BE PERFORMANCE-GUARANTEED

FIG. 15

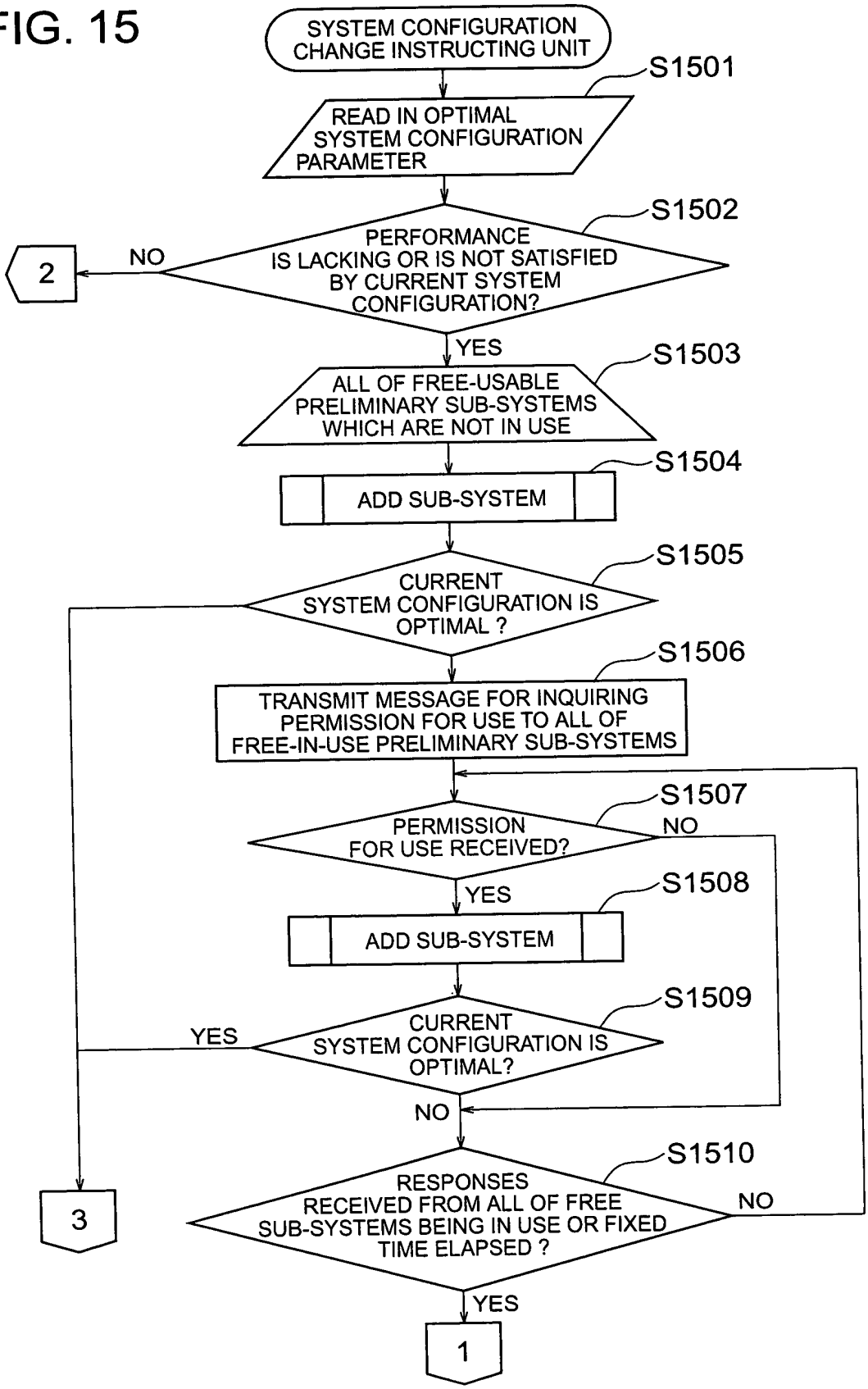
SYSTEM CONFIGURATION CHANGE INSTRUCTING UNIT
S1501
READ IN OPTIMAL SYSTEM CONFIGURATION PARAMETER
S1502
PERFORMANCE IS LACKING OR IS NOT SATISFIED BY CURRENT SYSTEM CONFIGURATION?
NO
2
YES
S1503
ALL OF FREE-USABLE PRELIMINARY SUB-SYSTEMS WHICH ARE NOT IN USE
S1504
ADD SUB-SYSTEM
S1505
CURRENT SYSTEM CONFIGURATION IS OPTIMAL ?
S1506
TRANSMIT MESSAGE FOR INQUIRING PERMISSION FOR USE TO ALL OF FREE-IN-USE PRELIMINARY SUB-SYSTEMS
S1507
PERMISSION FOR USE RECEIVED?
NO
YES
S1508
ADD SUB-SYSTEM
S1509
CURRENT SYSTEM CONFIGURATION IS OPTIMAL?
YES
NO
S1510
RESPONSES RECEIVED FROM ALL OF FREE SUB-SYSTEMS BEING IN USE OR FIXED TIME ELAPSED ?
NO
YES
3
1

FIG. 16

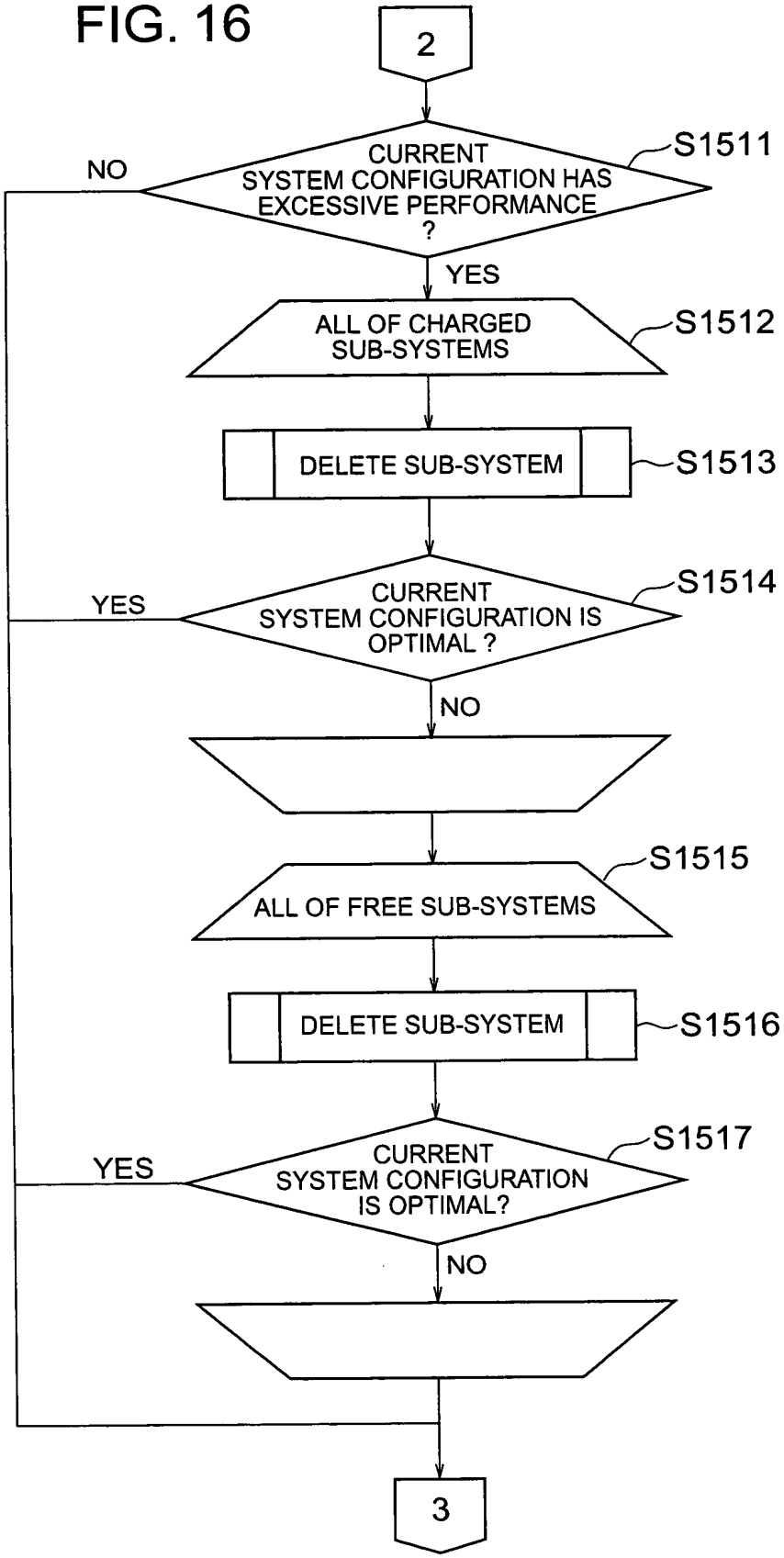
2
CURRENT SYSTEM CONFIGURATION HAS EXCESSIVE PERFORMANCE ?
S1511
NO
YES
ALL OF CHARGED SUB-SYSTEMS
S1512
DELETE SUB-SYSTEM
S1513
CURRENT SYSTEM CONFIGURATION IS OPTIMAL ?
S1514
YES
NO
S1515
ALL OF FREE SUB-SYSTEMS
DELETE SUB-SYSTEM
S1516
CURRENT SYSTEM CONFIGURATION IS OPTIMAL?
S1517
YES
NO
3

FIG. 17

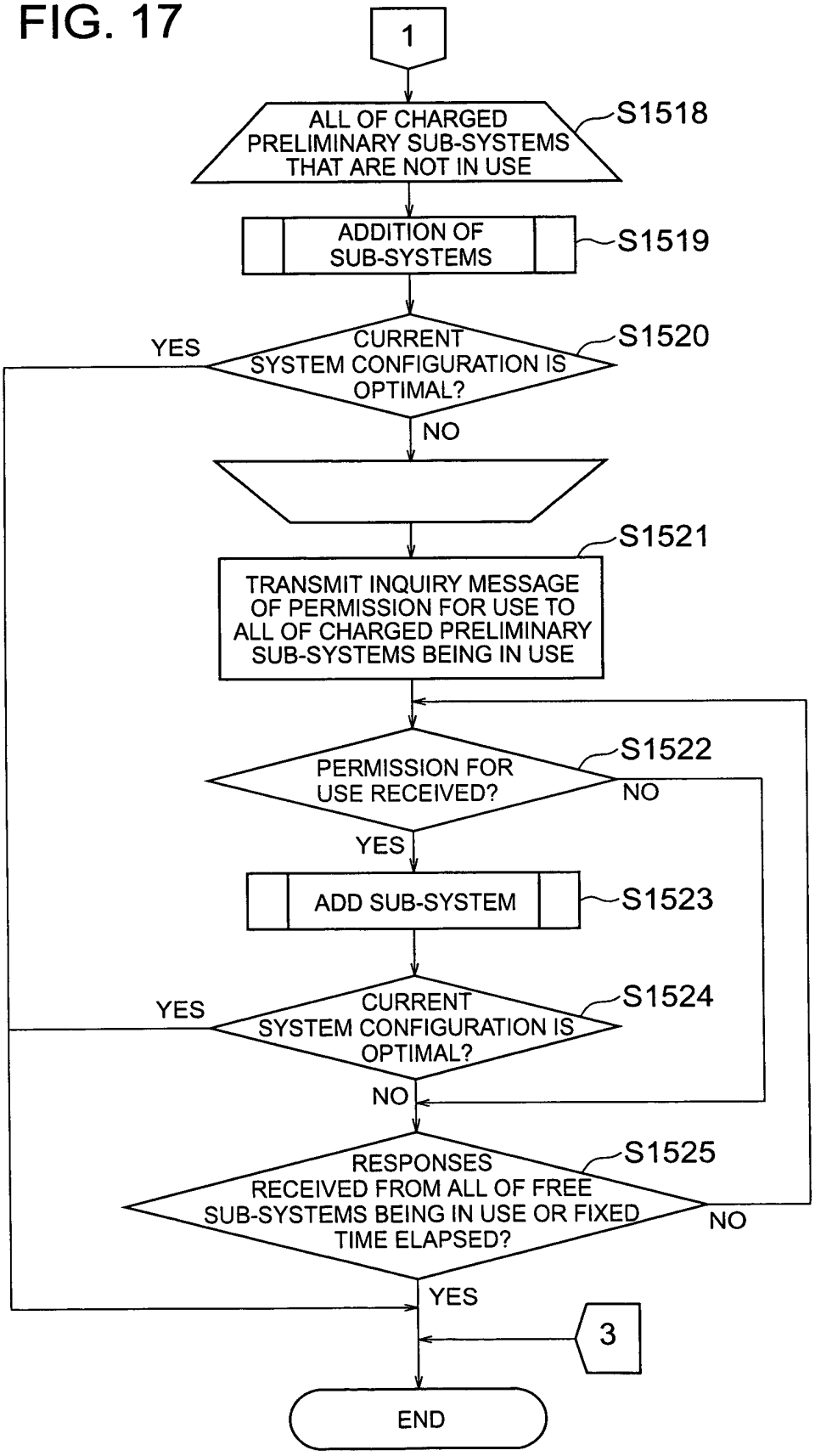
1
ALL OF CHARGED PRELIMINARY SUB-SYSTEMS THAT ARE NOT IN USE
S1518
ADDITION OF SUB-SYSTEMS
S1519
CURRENT SYSTEM CONFIGURATION IS OPTIMAL?
S1520
YES
NO
S1521
TRANSMIT INQUIRY MESSAGE OF PERMISSION FOR USE TO ALL OF CHARGED PRELIMINARY SUB-SYSTEMS BEING IN USE
PERMISSION FOR USE RECEIVED?
S1522
NO
YES
ADD SUB-SYSTEM
S1523
CURRENT SYSTEM CONFIGURATION IS OPTIMAL?
S1524
YES
NO
RESPONSES RECEIVED FROM ALL OF FREE SUB-SYSTEMS BEING IN USE OR FIXED TIME ELAPSED?
S1525
NO
YES
3
END

FIG. 18

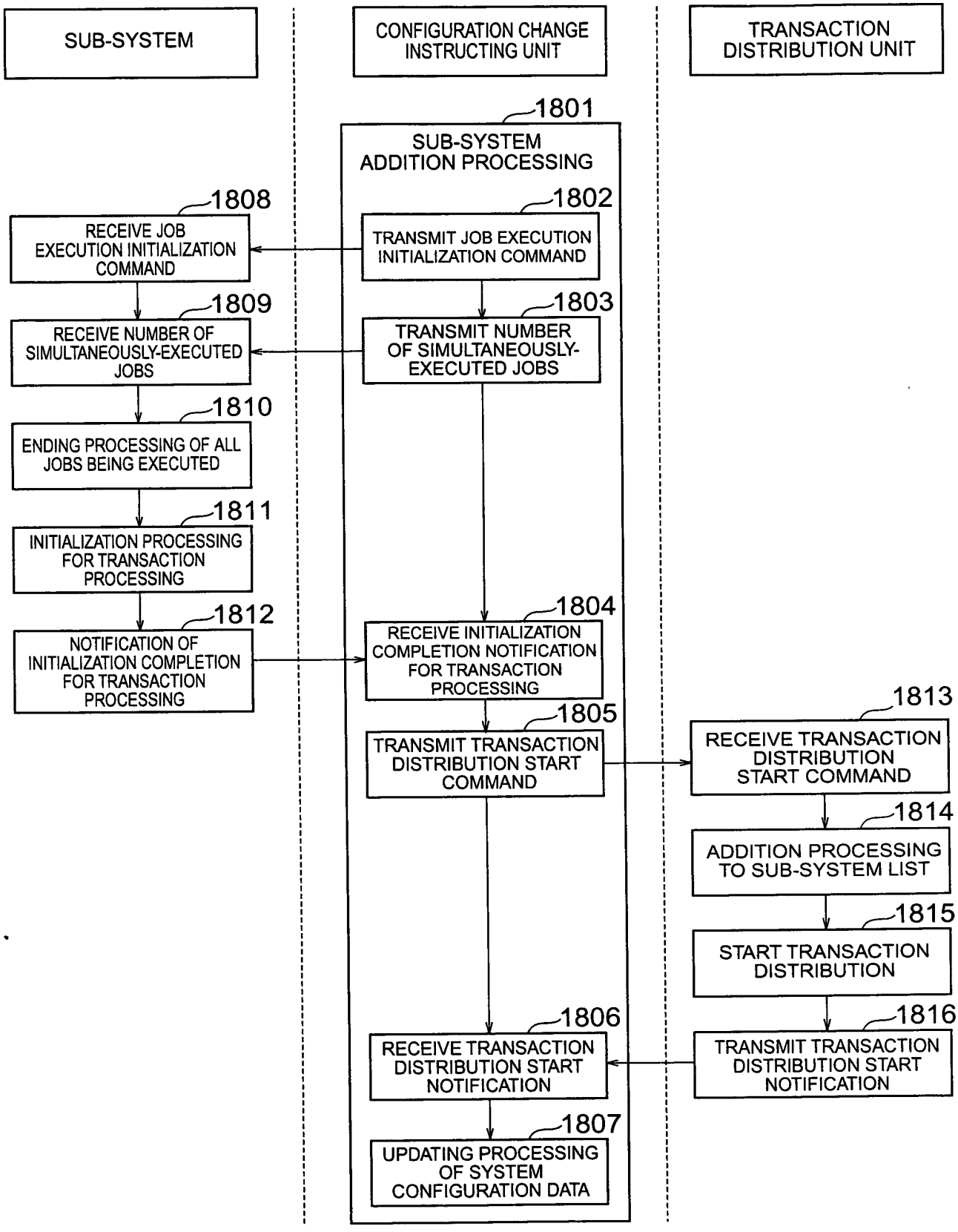
SUB-SYSTEM
CONFIGURATION CHANGE INSTRUCTING UNIT
TRANSACTION DISTRIBUTION UNIT
1801
SUB-SYSTEM ADDITION PROCESSING
1802
TRANSMIT JOB EXECUTION INITIALIZATION COMMAND
1808
RECEIVE JOB EXECUTION INITIALIZATION COMMAND
1803
TRANSMIT NUMBER OF SIMULTANEOUSLY-EXECUTED JOBS
1809
RECEIVE NUMBER OF SIMULTANEOUSLY-EXECUTED JOBS
1810
ENDING PROCESSING OF ALL JOBS BEING EXECUTED
1811
INITIALIZATION PROCESSING FOR TRANSACTION PROCESSING
1812
NOTIFICATION OF INITIALIZATION COMPLETION FOR TRANSACTION PROCESSING
1804
RECEIVE INITIALIZATION COMPLETION NOTIFICATION FOR TRANSACTION PROCESSING
1805
TRANSMIT TRANSACTION DISTRIBUTION START COMMAND
1813
RECEIVE TRANSACTION DISTRIBUTION START COMMAND
1814
ADDITION PROCESSING TO SUB-SYSTEM LIST
1815
START TRANSACTION DISTRIBUTION
1816
TRANSMIT TRANSACTION DISTRIBUTION START NOTIFICATION
1806
RECEIVE TRANSACTION DISTRIBUTION START NOTIFICATION
1807
UPDATING PROCESSING OF SYSTEM CONFIGURATION DATA

FIG. 19

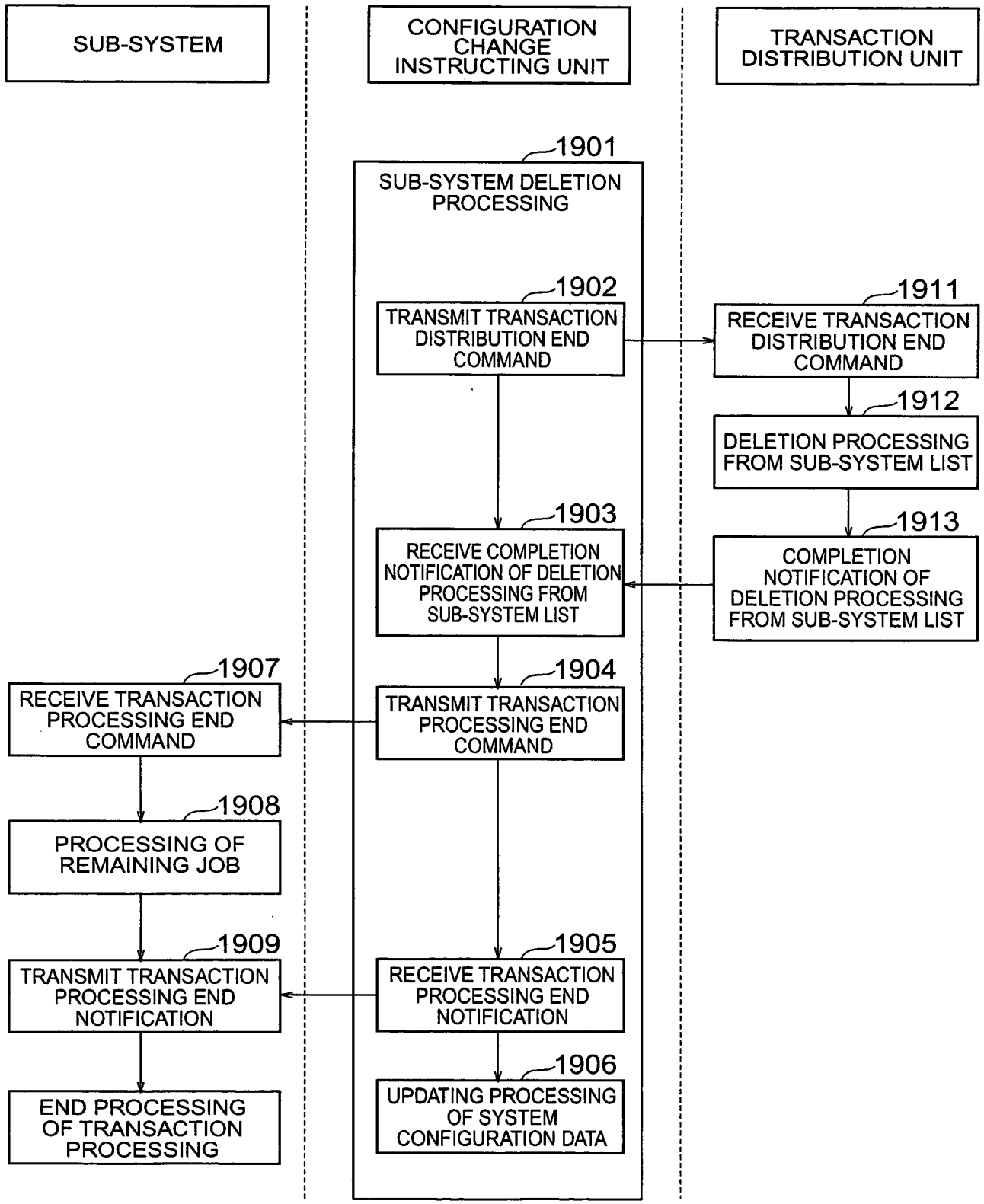
SUB-SYSTEM
CONFIGURATION CHANGE INSTRUCTING UNIT
TRANSACTION DISTRIBUTION UNIT
1901
SUB-SYSTEM DELETION PROCESSING
1902
TRANSMIT TRANSACTION DISTRIBUTION END COMMAND
1911
RECEIVE TRANSACTION DISTRIBUTION END COMMAND
1912
DELETION PROCESSING FROM SUB-SYSTEM LIST
1913
COMPLETION NOTIFICATION OF DELETION PROCESSING FROM SUB-SYSTEM LIST
1903
RECEIVE COMPLETION NOTIFICATION OF DELETION PROCESSING FROM SUB-SYSTEM LIST
1904
TRANSMIT TRANSACTION PROCESSING END COMMAND
1907
RECEIVE TRANSACTION PROCESSING END COMMAND
1908
PROCESSING OF REMAINING JOB
1905
RECEIVE TRANSACTION PROCESSING END NOTIFICATION
1909
TRANSMIT TRANSACTION PROCESSING END NOTIFICATION
1906
UPDATING PROCESSING OF SYSTEM CONFIGURATION DATA
END PROCESSING OF TRANSACTION PROCESSING

FIG. 20

2001 SUB-SYSTEM IDENTIFIER	2002 USE/NON-USE FLAG	2003 USE CHARGE PER UNIT TIME (ACCOUNTING AMOUNT)
001	ON	0
002	OFF	0
003	ON	1,000
004	ON	2,000
005	OFF	2,500